

# Understanding Trees Better

A Teacher's Guide Book  
by Nepal Prakriti Pathshala





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If you require our help, advice regarding any activities, ideas to improve environment within school, to establish nature clubs or just revive old ones or if you just want to share your stories, please contact:

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**Foreword**

Environment Education is of paramount importance in the present context of Nepal. Nepal's natural resources are one of the most important natural heritages that we must learn to use with care and intelligence. We must ensure that not only us but the future generation also gets the opportunity to harvest its benefits in abundance. And this is only possible if our education system ingrains environmental values in the students from the very beginning.

This is why I am highly impressed with the concept and working modalities of Nepal Prakriti Pathshala, an initiative of Wildlife Conservation Nepal and Danish Forestry Extension that is trying to build new grounds in terms of approach to teaching using integrative and hands-on experience methods.

Department of Education of Nepal appreciates the effort of Nepal Prakriti Pathshala to bring out this series of teachers guides that supplements the government's curriculum in Environment Science and also help the students to become more aware of their immediate natural surroundings and understand the role each human being plays to make it better. I am very happy that these manuals have been tested with more than hundred teachers of Environment Science in a workshop organized by Nepal Prakriti Pathshala and that they have found it to be a highly educational and easy to use tool.

I am confident that this manual "Understanding Trees Better" will definitely help the teachers in raising awareness about environmental and natural resource issues among their students and their communities and I hope it also instigates the teachers, and the students to act as agents of change in the society.

Mr. Mahashram Sharma  
Director General  
Date: 10 Jan. 2010



# ACKNOWLEDGEMENT

The development of this manual has been through many meetings, workshops and interactions with different teachers, academicians and school principals. And Nepal Prakriti Pathshala (NPP), a joint venture of Wildlife Conservation Nepal and Danish Forestry Extension, would like to express gratitude to many individuals and institutions that have directly and indirectly helped in bringing out this manual.

NPP would like to express its sincere gratitude to Mr. Mahashram Sharma Director General, Department of Education, for his invaluable guidance. Our heart felt appreciation to Ms. Rajyalaxmi Nakarmi, Deputy Director, Department of Education for her constant support.

The Project is grateful to all the teachers who gave their time and effort in making this teachers' guide possible especially Ms. Eva Skytte, Nature Interpreter from Denmark and Mr. Prajwol Babu Gongal.

NPP would like to thank the illustrator Abin Man Shrestha for his beautiful illustrations and to the creative team at WCN for their valuable research and painstaking work in publishing the manual.

Lastly, NPP is most grateful to DANIDA Denmark for their belief in NPP and their kind support without which this manual would not have been possible.



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## NOTE TO TEACHER

WCN Nepal Prakriti Pathshala's (NPP) objective is to provide quality materials on Environment Education that will help teachers to make their classroom lectures more fun, hands on and impart knowledge on environment.

This manual in particular deals with trees written for students of 12-16 years of age. It will provide them with a wide range of activities on getting to know trees better. These activities will encourage them to be creative and critical individuals to be proactive in building a conducive environment around them. The students will also learn to use different tools to access information (i.e. libraries, internet, videos) to collect information and knowledge and share it with their colleagues. The activities described in this manual can be used to develop skills in subjects like mathematics, science, social studies, health and literature.

This manual has been developed through the outcome of many workshops and brainstorming sessions with teachers, Nature Interpreters and environment educators of Nepal and Denmark. However, we consider this as a new tool for learning and thus invite your valuable suggestions and creative ideas.

In the end we hope that this teaching manual helps you and your students "Understand Our Trees Better"





## INTRODUCTION

Trees are the largest of all plants and some even survive for thousands of years. The oldest known tree is a 9,550 year old spruce in the Dalarna province of Sweden. Nobody knows exactly how many species of trees exist on earth. Estimates run from 10, 000 to 100,000 species. About 400 species of trees are estimated to be found in Nepal alone.

Trees form an important part of our daily lives. They have been living on this earth for millions of years now, and have contributed to sustaining life on earth by cleaning the air and helping in maintaining moisture in its surroundings. In addition, trees make the environment beautiful with different colours, flowers, sizes and shapes. Often called nature's air conditioners, trees provide shade and relief from the sun's heat and harmful rays. They block off noise around our homes and also act as wind breaks. Trees in general give us a sense of peace and helps us relax, provide homes to innumerable organisms and also protect our soils from erosion. Some are also used as medicines when we are sick and food when we are hungry. Trees have been used by man for numerous purposes such as building materials, furnitures,paper, etc.

The area with trees as the dominant feature is called a forest. Forests are the factories of oxygen and control carbon dioxide in the air. Forests at present cover only 9.4% of the Earth's surface (or 30% of total land area) and 21% of Nepal's area is covered with forests. It has been steadily decreasing over the past few years. We are losing forests for development activities, settlements and rampant and sometimes illegal tree fellings for economic benefits. This trend is dangerous as it is slowly robbing earth of its natural carbon dioxide sink and perpetuating global warming.

Global warming is caused by the increasing amount of green house gases like Carbon Dioxide, Methane, Nitrous Oxide etc released in the air. These gases trap heat from sunlight falling on earth and stop them from escaping back into space. The process makes the atmosphere become hotter and changes the climate patterns which in turn brings many environmental problems and food insecurities around the world. Climate Change can be slowed down by changing our habits, by making informed choices on how we live our lives and by planting trees in our lifetime.

Statistics show that if we do not plant 10 trees in our lifetime then we are using someone else's. Programs like Community Forestry of Nepal are the success stories that must be emulated around the world. Community Forestry has changed many degraded forests into lush green ones.

So let us begin a new chapter on caring trees and protecting the environment today as there is no time as NOW!

# CHAPTER 1: KNOW YOUR TREES



## Activity: My Tree's Vital Statistics

### Concept

A tree is a perennial woody plant that has many secondary branches with leaves extended from the ground on a single main stem. Its life cycle begins from a seed which germinates, grows, reproduces and eventually dies, making fertilizer for the next tree. Although trees come in different shapes and sizes, each has the same basic parts. Each of these parts - from the highest leaves in the crown to the tiny root hairs buried in the soil - play an important role in the tree's function and survival.

#### Crown

The crown of the tree is made up of the leaves and branches. The green leaves are the food factories where photosynthesis occurs. In presence of sunlight carbon dioxide from the atmosphere and water from the roots are drawn to create sugar or food and oxygen. The inner bark then carries this food to all living parts of the tree. In turn, oxygen and water are released into the atmosphere as by-products of photosynthesis.

#### Trunk

The Trunk of the tree supports the crown and serves as a highway for food made in the leaves to travel to the roots and for water and nutrients from the roots to travel to the leaves. The trunk consists of four layers wrapped around one another. These layers, from the centre outwards are the xylem, cambium, phloem and the bark. The xylem is the woody, central part of the trunk. As a tree grows, older xylem cells in the center of the tree become inactive and die, forming heartwood. Because it is filled with stored sugar, dyes and oils, the heartwood is usually darker than the sapwood. The main function of the heartwood is to become stiff and support the tree. Sapwood on the other hand comprises the youngest layers of wood that has tiny pipelines that carry water and small amount of dissolved minerals (sap) from the roots to the leaves.

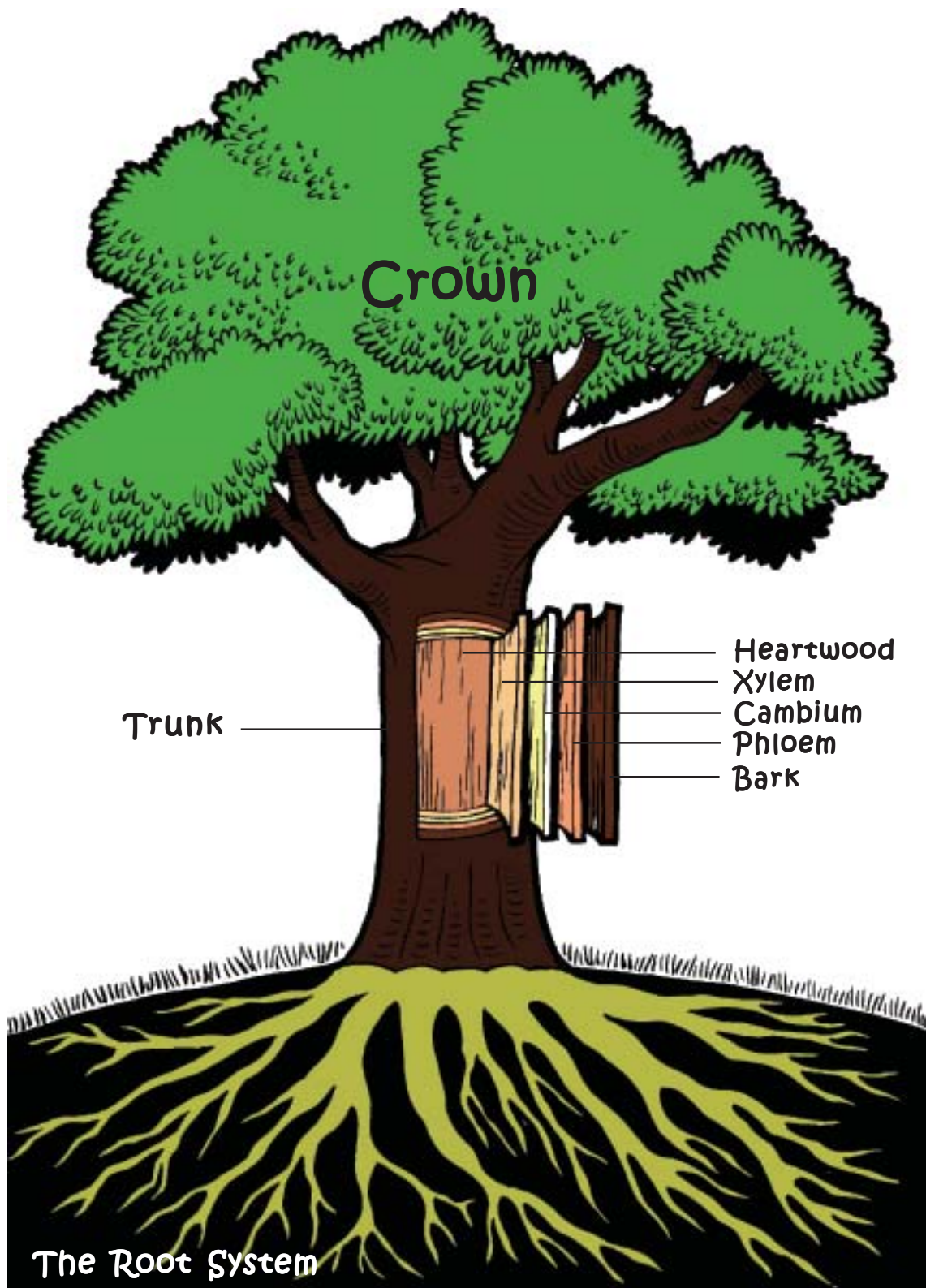
The cambium is a one cell thick layer of growing tissue which surrounds the xylem. It makes the trunk, branches and roots grow thicker.

The phloem, also called the inner bark is a layer of soft tissue surrounding the cambium and has tiny pipelines like the xylem. In the phloem, sugar that is made in the leaves is carried down to the branches, trunks, and roots, where it is converted into the food (starch) the tree needs for growth. The outermost part of the trunk is called the Bark. It acts like a tree's armor and protects it from external injuries and threats. It also gets rid of the wastes by absorbing and locking them into its dead cells and resins.

#### Root

The Roots of the tree support the trunk and crown, and also anchor the tree in the soil. They serve as a storage facility during the winter for the food produced by the leaves during the growing season. The roots also absorb water and nutrients from the soil.

# Activity 1



## Types of Trees

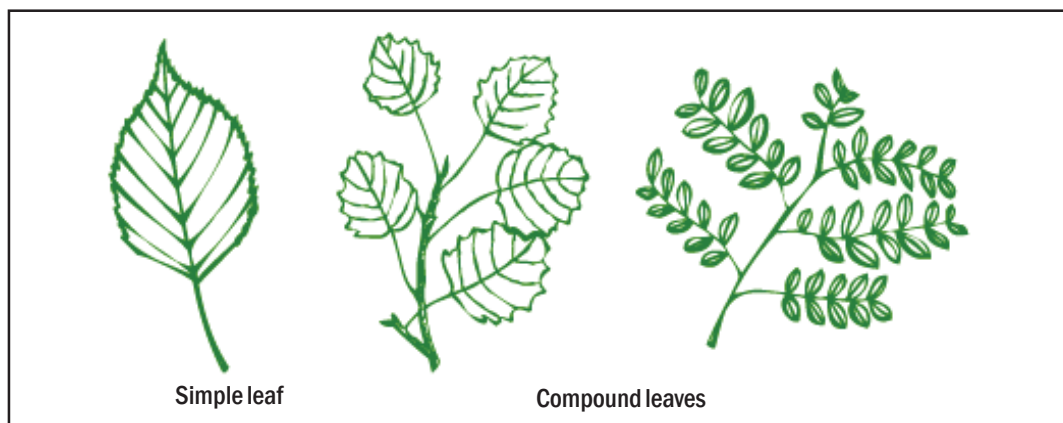
Trees are classified according to their features and characteristics. Some trees have leaves that are evergreen while others are green and dry up in some seasons. Here is a list of different types of trees.

**I) Deciduous trees:** This one loses its green colour at a certain time in season.

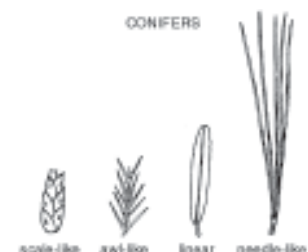
**II) Evergreen trees:** Where its leaves are always green despite the climatic condition of the season.

The other type of trees can be classified on the types of leaves they have. Leaves are one of the most important feature of a tree that distinguishes between different types. Different trees have different shaped leaves.

**I) Broadleaf tree:** Leaves are broad and flat and can be found widely spread from temperate to tropical regions.



**II) Coniferous tree:** Leaves are needle like and are evergreen but bear cones. The examples are; bald cypress, pine, spruce and cedar. They have been in existence for more than 290 million years. History shows that they evolved before the broad-leaved trees. The presence of such trees tend to make the soil acidic.



## Purpose

The purpose of this activity is to make students aware of trees around them and make them familiar with trees, make them learn some tree terms, and their physical attributes. After this activity the students will be able to measure and understand the age, trunk, crown, and height of a tree using simple methods. They will also learn about tree leaves and types of trees based on leaves.



## Resources & Materials

1. Measuring tape or string and a ruler
2. Tree
3. Note book, chart paper and coloring pencils

## Activities and Procedures

**BUILDING YOUR TREE:** This activity will be a way of teaching each other about trees. It will also be a way of knowing how much the students already know about trees and hence can be a benchmark on how to begin learning about trees.

1. First divide the students into groups. Each group identifies one tree to learn about. Collect materials from the surroundings. This can be leaves, plastic, branches and other pieces of garbage. Make a tree on the ground or at the base of 'your tree' from the collected materials. A tree with roots, stem and crown or just how you think it looks.

2. Discuss in your group the purpose and function of every part of the tree and make small notes to place on their tree. Each group should show their tree to the other groups and share with them what you have found out about trees through discussions.

Using Metric system, now perform the following exercise to know more about your tree.

### **DETERMINING AGE:**

1. Measure the girth of the tree at about 150 cm from the base using a string and divide the result by 2.5 to get the approximate age of the tree.

2. For conifers and some deciduous trees like maple, you can count the internodes and the total number could also mean its age.

### **DETERMINING TRUNK:**

1. Measure from the ground a little less than 1 meter high on the trunk. At that height, measure the trunk's circumference. Use a string around the trunk and measure the length of the string.

2. Record the length and label it as circumference.

### **DETERMINING CROWN:**

1. Find the tree's five longest branches. Put markers on the ground beneath the tip of the longest branch.

2. Find a branch that is opposite it and mark its tip on the ground and measure along the ground from first marker to the second marker. Record the number and label it as crown.

### **DETERMINING HEIGHT:**

1. Make your partner stand at the base of the tree. Back away from the tree, holding your ruler in front of you in a vertical position. Keep your arm straight.

2. Stop when the tree and the ruler appear to be the same size. Close one eye to help you line it up and turn your wrist so that the ruler looks level to the ground and is in a horizontal position. Keep your arm straight.

3. Make your partner walk to the spot that you see as the top of the ruler. Be sure the base of the ruler is kept at the base of the tree. Now measure how many feet he or she walked. That is the tree's height. Round it up to the nearest meter and record your answer as the height.

### **TRACING TREE LEAVES:**

1. To see how many trees we have in the surrounding that are deciduous or evergreen and broad leaved or needle leaf, collect different leaves found in the experiment area. Bring them back to class and trace its outline, copy the veins and colour the leaves in a chart paper.

2. Determine what type of leaves they are and the kind of tree its coming from.

### **THINKING CREATIVELY ABOUT TREES:**

Prepare a presentation on your tree, using the results and the information you have obtained from this activity. Write a story about your tree. About what could have been its past, its present and what could be its future. Share this with the class.



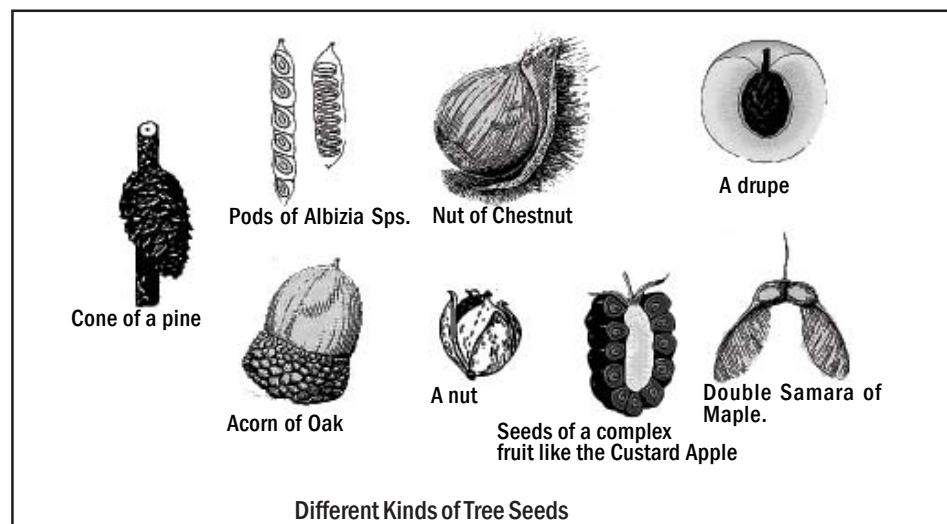
## Activity: Learning about Seeds

### Concept

Seeds are structures formed in the cones or flowers of trees and are identified with sexual reproduction. Once the female parts are fertilized with the pollen produced by the male parts of the flower, they form seeds. Although most seeds are very small, they are capable of growing into a new tree. These seed can help in keying out and identifying a specific species of tree. Not as common as a leaf, a fruit or seed pod might only be found at certain times of the year.

Seeds may remain inactive for weeks, months, or even years, lying in wait for growing conditions to be just right for sprouting. When the temperature is favorable and the water supply is adequate, they become active and quickly begin to sprout and grow. Seeds are found in a wide variety of shapes, colors, and sizes. Many times fruit bearing trees have seeds concealed within its fruits. Fruits such as mangoes, apples, avocados, oranges, guava, peach, pears, etc. have seeds within them that can be germinated. Other times, its the seeds that are edible, such as the walnut, cashewnuts, cacao.

Seeds also contain stored food, intended to nourish the new plant as it begins to grow, and these proteins and carbohydrates are a rich source of nutrients for animals, including humans, as well. As a matter of fact, it is seeds that provide most of the people of the world with their staple foods - wheat, corn, and rice.



### Purpose

The purpose of this activity is to familiarize the students with different kinds of seeds of trees and learn about the long process of the cycle of the trees' lives. In this activity, students will collect and examine a variety of seeds and will plant the seeds to discover which ones grow. Many of their assumptions about what is and what is not a seed will be challenged as they work through this activity.

## Resources & Materials

1. Different Seeds
2. Chart paper and color pens
3. Flower pots and soil
4. Water

## Activities & Procedures

1. To see how many trees we come into contact with during our day to day life, be it in our surroundings or fruits we eat or trees that we use as medicines, ask your students to collect different seeds of trees.
2. Bring them back to class and figure out which seeds actually come from trees and which do not.
3. Determine what type of seeds they are and the kind of tree its coming from. Examine the seeds and discuss how do they spread. Are they very light? (dispersed by wind), Are they sticky? (Dispersed by animals) Do they look delicious? (Dispersed by animals or humans) Or Do they float? (Dispersed by water)
4. Take one seed each and write an autobiography of that particular seed, its journey and on how it becomes a tree.



### Planting the Seeds:

Planting seeds is quite fun and this exercise will also develop on sense of responsibility. Artificial germination of seeds means using various techniques to mimic the role nature plays in causing tree seeds to germinate. Many seeds require one or more treatment steps to stimulate the germination process. The three most common steps are: 1) Scarification, 2) Cold Stratification, and 3) Warm Stratification. Keep in mind that not all seeds require all of these steps. In fact some seeds do not require any pre-treatment at all.

1. Seeds may be sown into flower pots or into seed trays. Most tree seeds are planted much shallower than other annual seeds, but typically seeds can be sown into the soil by maintaining a planting depth of about 2-3 times the size of the seed.
2. The seeds should be sown in a well-drained medium, such as a mixture of peat moss and vermiculite.
3. When sowing the seeds, fill the container or seed tray to about 1.27 cms from the top with the moist medium (soil).
4. Level the medium by gently shaking or taping the container. Mark the pots so you remember which pot has what seeds you have planted.
5. Leave the set up where there is plenty of sunlight. Water it everyday and wait and watch.

Some seeds might not germinate because there was not enough water or too much water at the right season. You can do some research on this (you can do it before the exercise too) and discuss in class what went wrong. Remember seeds don't sprout in every season. It is best

to start this activity after the winter. Spring is usually the time when sprouting of new plants take place.



## Activity: Making a Herbarium

### Concept

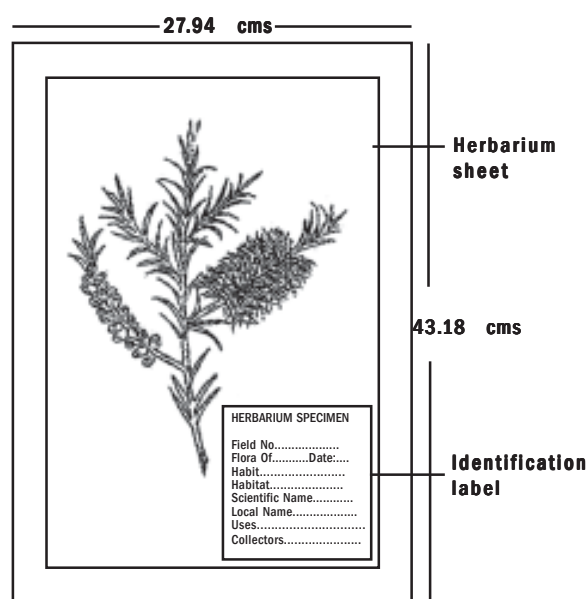
Human use trees and plants in almost every aspect of their life: for food, shelter, clothing, energy, decorative purpose, religious ceremonies and even in death. In addition, trees are also used widely for medicinal purposes. The medical system Ayurveda is considered the earliest source on medicinal plants in which the properties of drugs and their uses are given in detail.

#### Some common trees and their different uses:

1. Amala (*Embica officinalis*) – Rich in Vitamin.C, used for cold, diarrhoea, diabetes, etc.
2. Bel (*Agele marmelos*) – Used to control Diabetes, diarrhoea and dysentery.
3. Neem (*Azadirachta indica*) – To recover from skin diseases or problems.
4. Apple (*Malus domestica*) – Used as fruit.
5. Bottlebrush (*Callistemon sp.*) – Used for ornamental purposes.

### Purpose

There are many trees that are found around our homes and communities which have medicinal as well as other values. It is important that we learn, understand and appreciate them for their immense benefit to our lives. The purpose of the activity is to make students develop familiarity towards the trees around them, learn to make herbariums for proper identity, storage and information about the tree life around one's locality, research area, etc. Luca Ghini was the botanist to be credited as the inventor of the herbarium in mid 1550s.



Herbarium Sample of a Bottle brush tree specimen



## Resources & Materials

1. Plant Cutter
2. Herbarium ( chart paper), identification labels, tags
3. Cello tape
4. Paper bags
5. Herbarium press
6. Blotting paper
7. Old Newspapers
8. Resource book on identification of trees

## Activities & Procedures

The procedure can be divided simply into three important major steps- Collecting, Drying and Mounting. Almost all locations are suitable for herbarium collection. It can be your school compound, school locality, home, forests, gardens etc. However, one has to respect the owner of the land and also make sure the collection will not hamper the plants and trees there in a massive amount. It is best to pick trees that seem quite dry, and lacking surface moisture thus rainy days and early mornings are to be avoided including afternoons.

### Collection

1. With the help of a plant cutter, cut small branches of trees with leaves that appear free from disease and insects. Flower is one of the most important feature of the plant for herbarium collection thus its better if flowers are available.
2. All specimens should be tagged and if you know its common name write its name.
3. Make notes in an observation book about the date, location, the color of flowers and fruits, and other information that you may find interesting. Draw the tree's size and shape so that you can remember it later on too.

### Drying:

1. Create a folder using old newspaper bundles. Gently spread the plant specimens into the sheets of the newspaper making sure both sides of leaves are seen and there are no overlaps. Every plant specimen should have paper on both the sides. Then put some heavy weight on the folder.
2. Leave it overnight or several days depending on the kind of the specimen. Change the newspapers every day, until the specimens are light and dry.

### Mounting

1. Prepare herbarium sheets made out of hard white blank paper or chart paper. A herbarium measures 27.94 cm X 43.18 cm in size.
2. Tape the stems of the dried specimen onto the herbarium sheets and leave the delicate parts like flowers, fruits and seeds free. Make sure both sides of leaves are shown.
3. All mounted specimen needs to be labeled. Prepare a label with the scientific name, your name, date and location of collection, the color of flowers and fruits pasted on the bottom right of the herbarium sheets.

This completes the making of a herbarium. They need to be maintained carefully. Silver fish and other insects could degrade them thus you can deter them by using repellents or keeping dried cloves or dried berries of *Xanthoxylum armatum* (timur in Nepali) with the herbariums.



## CHAPTER 2: LEARNING THE SECRETS OF PLANTS

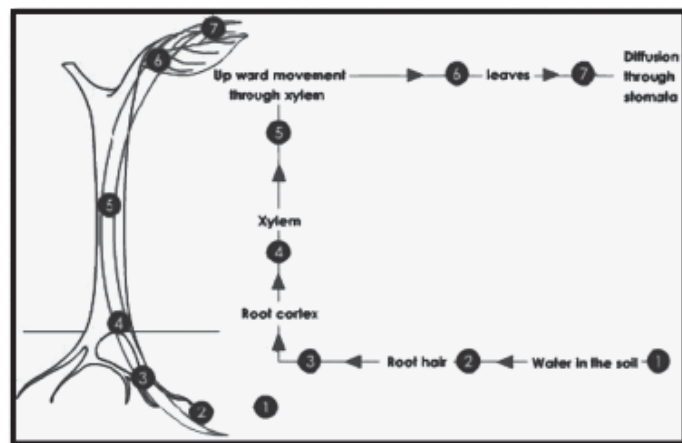


### Activity: Discovering Transpiration

#### Concept

The entry of water into the tree is through the root hairs. Water is used up in photosynthesis process in the leaves. Water also helps to transport nutrients throughout all parts of the plant. Water even helps support the plant by filling up in its cells so it can stand up straight. Water travels through long, thin tubes called **xylem**, running from the roots through the stem and into the leaves.

Water moves up the xylem through a process called **capillary action**. Capillary action allows water to be pulled through the thin tubes because the molecules of the water are attracted to the molecules that make up the tube. The water molecules at the top are pulled up the tube and the water molecules below them are pulled along because of their attraction to the water molecules above them. When plants have more water in their leaves than they need, they get rid of this extra water through a process called **transpiration**.



#### Purpose

To help students understand the mysterious ways of how trees maintain their life support systems. It is to show how water is absorbed through the root hairs and gradually transported to the leaves for photosynthesis and transpiration process.

## Resources & Materials

1. Stand
2. Green tree sapling or just leaves
3. Beaker
4. Water

5. If one cannot find a tree sapling then just place some green tree leaves in a balloon made of transparent plastic and leave it in the sun. After sometime observe small droplets appear in the plastic or on leaves showing the occurrence of transpiration in presence of sunlight.

This experiment can be carried out in different lighting conditions and the results can be discussed in the class.

## Activities & Procedures

1. Place a leafy green young tree sapling in a beaker with water as shown in the diagrams below. The beaker must be sealed with a plastic layer and also the leafy part of the plant.

2. Mark the level of water in the beaker and leave the set up in the sunlight for some time and observe carefully.

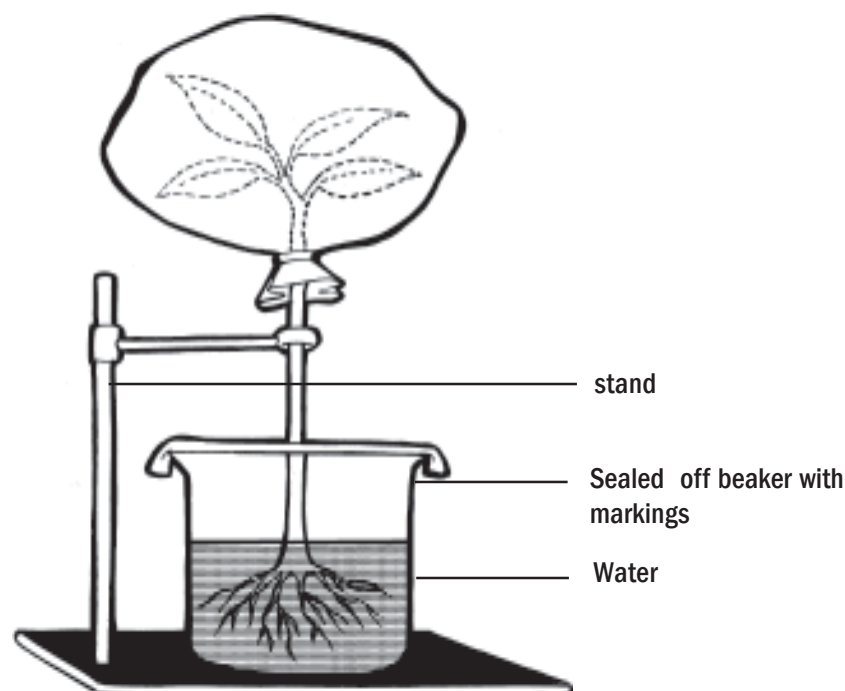
3. Drops of water will appear on the leaves and the water level will decrease in the beaker.

4. This shows the clear passage of water is through root hairs to the leaves.

### Note:

There are several factors that affect water absorption which then affects the rate of transpiration. Usually, when the rate transpiration increases so will the rate of absorption and the factors are as follows:

1. Availability of soil water (Capillary water)
2. Soil temperature- temperature below 4° C reduces the absorption of water. Absorption is maximum between 20-30°C temperature
3. Soil solutes - high soil solutes inhibit absorption
4. Aeration of soil – soil deficient in oxygen inhibits absorption





# Activity: Exploring Photosynthesis

## Concept

Of all the organisms in the world, green plants are the only ones that manufacture their own food. Green plants make their food by the process called photosynthesis. Plants use energy from sunlight to combine carbon dioxide from atmosphere and water drawn from the roots to make food, sugar and oxygen in presence of green pigment called chlorophyll. This process is the ultimate source of all the food we eat. Chlorophyll is contained in specialized compartments, or organelles, called chloroplasts. Photosynthesis is most first step in the food chain which connects all living things. The oxygen that is released by the process of photosynthesis is most essential for all living things. Forests are often called the factories of oxygen and giants sinks of carbondioxide because plants and trees in a forest take in carbon dioxide and give off oxygen in the process of photosynthesis in massive amounts.

## 5 Activity

$$\text{Photosynthesis: Carbon dioxide + water} \xrightarrow{\text{sunlight}} \text{oxygen + food (sugar)}$$

Leaves are the primary sites of photosynthesis in green plants. Stomata are pores in the leaves that allow carbon dioxide into the leaf, and also allow oxygen to be released into the environment. The inner bark then carries this food to all living parts of the tree. In turn, oxygen and water are released into the atmosphere as by-products of photosynthesis. However, during the night, in the absence of light, there is no



photosynthesis. During the night plants also respire and give out small amounts of carbon dioxide. Thus sunlight is the ultimate source of energy without which plants cannot manufacture food. Same things happen during winters. As winter approaches, the sunlight is not enough for the trees to manufacture food, so they shut of their food making processes. The green chlorophyll slowly disappears and green plants become yellow, red, and brown and ultimately fall off in autumn. The trees then live

off on stored food during summer.

## Purpose

To help students understand that without enough sunlight, plants cannot use the process of photosynthesis to produce food and to help students understand that the oxygen gas is produced during phoyosynthesis and at night, in absence of light, no photosynthesis occur and that plants produce oxygen as a biproduct of photosynthesis.



## Requirements

1. Test-tube
2. Small shrub, tree or house plant
3. Black chart papers or aluminum foil
4. Scissors
5. Paper clips
6. Jar
7. Magnifying glass
8. Green fresh leaf
9. Water

## Activities and Procedures

### Plants need light for Photosynthesis

1. Identify a tree whose branches may be reachable for the experiment. Or you can substitute a tree with a house plant or a potted tree.
2. Using the chart paper or aluminum foil, cut out some geometrical shapes like a circle, square or triangle. Make sure your shapes are big enough to make a patch that will cover nearly half of the plant leaf.
3. Using paperclips attach each shape on a different leaf.
4. Leave the set-up in sunlight. Choosing leaves on the south, east and west sides are appropriate as they receive maximum amount of sunlight.
5. After three to four days, remove the shapes from the leaves and observe each of the leaves that had a shape covering it.
6. Compare the areas on the leaf that were covered with the shape to other parts of the leaf.



### Plants produce oxygen during photosynthesis

1. Fill the jar with water. Put a tree leaf in it and leave the jar in the sun. Wait a couple of hours. Now study the leaf with magnifying glass. Small bubbles of oxygen should be forming on the leaf.
2. Experimenting in the light and darkness: Fill three jars with water and put a leaf in each of them. Put one set up in the sun, one in the shadow and one in total in darkness. Now count the bubbles. After one hour count the bubbles again and maybe after two hours. In which is the amount of bubbles highest?



Time	Number of Bubbles		
	Leaf in light	Leaf in shadow	Leaf in darkness
0 hour			
1 hour			

Another way is to test with leaves from different trees to determine which trees manufacture more oxygen under the same conditions.

## CHAPTER 3: BENEFITS OF TREES



### Activity: Tree as a Habitat

#### Concept

Trees are habitats for many organisms. Many insects, critters, butterflies, birds use trees as their habitat. Not only these small creatures, but many plants and animals like the algae, mosses, orchids, frogs, squirrels, monkeys, gorillas and even man use trees as habitat. This way forests are one of the most diverse habitats or ecosystems for organisms and is very important for their survival. Organisms in an ecosystem are interdependent and have a intimate relationships with each other and thus to maintain this change it is important that we learn about them.

#### Purpose

The objective of this activity is to create awareness among students and make them understand the variety of species are taking shelter in a single tree. This will also enable them to investigate the interrelationships between trees and the animals that inhabits them. With this activity the students will be using a homemade bug vacuum to collect insects from the tree they are to understand that a single tree can be a habitat for many organisms.



## Resources & Materials

1. Bug vacuum or a petridish
2. Bug magnifier or a simple magnifying glass
3. Binocular
4. Identification book
5. Note copy, pencils

## Activities & Procedures

1. Observe the trees for evidence of animal inhabitants: insects, birds, and small mammals.

2. Look for evidence of animal homes. Insect homes include willow galls, oak balls, borings in the bark tent caterpillars, bag worms, leaf rollers, carpenter ants.

3. Make two columns on your notebook, one for drawing the insects you see and the other for recording the number of each kind (species) of animal you observe.

*Optional:* Drawing a picture of each type of insect is an additional way in which you can describe the insects you collect. This way you can remember them too in the long run.

4. Try to investigate each tree with as much detail as possible. Use a hand lens to note the smallest details.

5. When you find an insect, gently collect insect by using bug vacuum or a petridish and study the characteristics through Bug Magnifier.

6. Examine the insects you collected by looking at them through the plastic wrap window of the insect vacuum. How many different types of insects did you collect?

7. When you are done examining the insects, you should release them to the same place when they were caught unharmed.

8. Apart from insects, observe if the birds inhabit the trees. Study the feather colour, beak, and tail etc. of bird through a binocular. They can be properly identified with the help of Local Bird Identification Books.

9. When you are done discuss with your teacher and friend the role the tree plays in each of the animals' lives. Discuss how the animals and plants contribute to changes in the tree. Which changes may be beneficial or detrimental to the tree? Are organisms harmful, beneficial, neutral to tree?

Note: This activity can be followed up with drawing of a collage, poster and put up in the class to remind how important one tree is for several organisms.





## Activity: How Trees Stop Erosion

### Concept

Erosion is the removal of soil, sediments, rock and other particles in the natural environment, due to water, wind, or biological factors or organisms. Erosion is a natural process but in many places it is increased by human activities. Poor land use practices, deforestation, overgrazing, unmanaged construction activities and road-building often accelerate erosion by water and loss of land and property. Even though a certain amount of erosion is natural and healthy for the ecosystem for formation of soil, excessive erosion causes problems like landslides in steep slope areas, water with sedimentation, ecosystem damage and loss of top soil.

Vegetation is a key factor in erosion prevention, particularly on steep slopes. Retaining native trees, shrubs and grasses on slopes can greatly reduce erosion damage. These can also be called Bioengineering techniques. In addition, there are many agricultural practices like SALT that reduce erosion damage and limit the loss of valuable topsoil; especially those practices that minimize tillage and irrigation are preferred.

Trees stop soil erosion as their roots hold the soil together, preventing the soil from eroding and also reduce the speed of flowing water there by reducing the erosion.



### Purpose

Students learn about the role of trees and plants in preventing erosion. Students understand erosion and can point out erosion occurring in their own surroundings and learn how detrimental erosion can be to an ecosystem without plants and trees. Students discover the importance of having trees on steep slopes and have the opportunity to work together to proactively prevent erosion through tree planting through a model.

## Resources & Materials

1. Two oil tins or aluminium baking trays
2. Tin cutter
3. Bucket full of soil
4. Water ( in a water spray is preferable)
5. Rocks, pebbles etc
6. Grasses with roots etc

### Erosion around us:

1. Conduct a survey in the school compound point out evidence of erosion on the school grounds. Some good examples are often near drains, drainpipes, and at the edges of the blacktop of roads. When students find examples of erosion, they are to describe it in their notebooks and draw a labeled rough sketch of the erosion.

2. After students are back in the room, ask them to share what they have written in their journals about the effects of erosion on the playground or school property.

### Building a Erosion Model:

1. Cut two oil tin container in a slant way. A disposable aluminum baking tray can be used as well.

2. Put enough rocks and soil to fill the tray or the tin. The tins when filled should look like a slope of land.

3. Have one Tin A with nothing but soil, loose rocks and pebbles.

4. In another Tin B, pack soil around stones, sticks, leaves, roots and plant some grasses if possible to make it look like vegetated slope.

5. Pour little drops of water preferably through a water spraying tin number A, starting at the highest part of the tilted tray or the tin, so that water can run down the soil.

6. Ask students to notice if any changes are taking place in their trays. See if the soil or rocks are moving out of position.

7. Direct the other student to pour larger amounts of water at the highest part of the tray like heavy rainfall.

8. Report the same procedure in tin B.

9. Again, describe what changes are taking place in the tray. Are there signs of erosion? In which tin is the effect of erosion seen most and why do you think it was like that.

There are a whole lot of things that can be discussed from how trees act as biological defence against erosion and landslides to how small erosion is also good for soil formation.





## CHAPTER 4: MAKING A DIFFERENCE



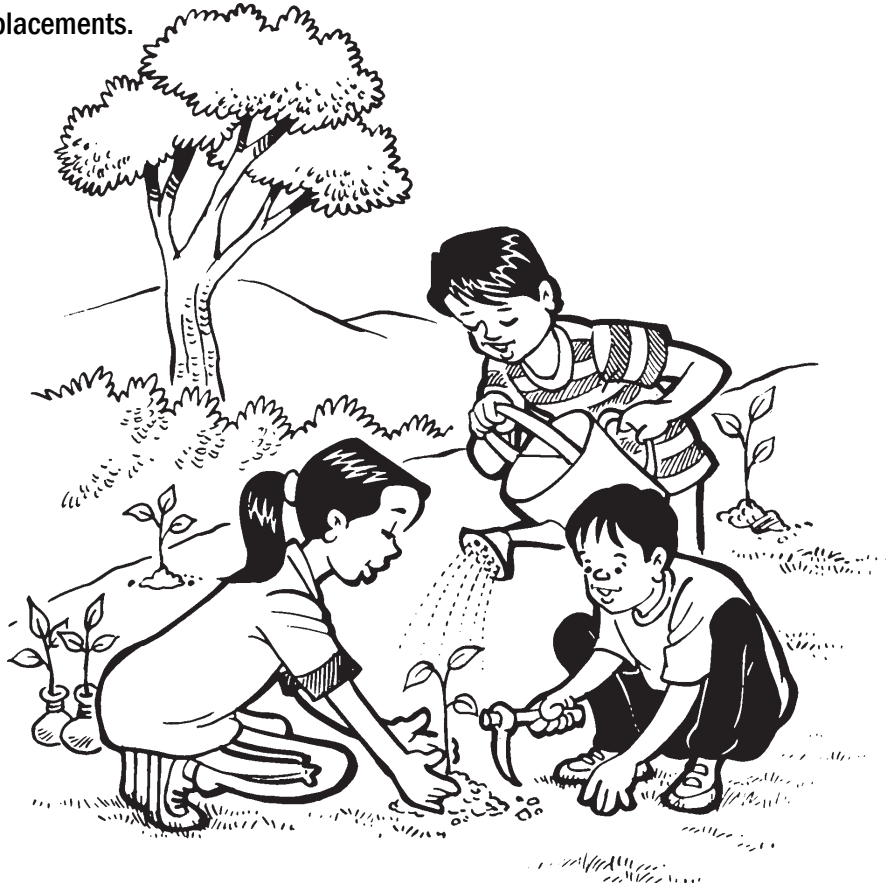
### Activity: Planting a Tree

#### Concept

Trees are most important in our lives. They provide us with many benefits that have most intrinsic values. However, in today's world especially in city areas we do not see a lot of trees. Old trees are cut down to broaden roads or make place for new buildings and homes. Slowly we are seeing very less of trees in our immediate vicinity. It is very important that we do not lose the sense of importance of having greenery in our surroundings. It is also scientifically proven that looking at trees and greenery is very good for one's mental health. Planting trees is also one of the best solutions to global warming. Thus it is utmost important that we cultivate the habit of planting and taking care of trees.

#### Purpose

Even though we learn about the importance of trees and plants in our environment and lives, we do not feel the need to be responsible for them or for the lack of them in our surroundings especially in cities and developing towns. Thus, this activity is to give students a hands-on experience to plant a tree and also the responsibility to take care of it. It is also to make the practitioner aware of how long does a tree need to grow and thus understand the enormity of loss of every tree cut down without replacements.



## Resources & Materials

1. Area, available for planting the tree
2. Sapling of the tree, seed or a grown plant
3. Spade
4. Water

## Activities & Procedures

### 1. Selection:

A tree planted correctly, will grow twice as fast and live twice as healthier than the one that is not. A right tree must be planted in the right place.

**A) Site Selection:** It is vital that a careful survey is done in the area where you want to plant your tree. A simple layout must be drawn on how will the tree look when it is fully grown.

Three things must be carefully taken into consideration:

i) Its height and crown cover : Will it hamper existing structures or gardens or other trees when its fully grown?

ii) Its root system: Make sure that the root system will not grow into underground sewers, water and other pipelines.

iii) Sunlight and moisture: Does the site have enough of both?

**B) Tree Selection:** Tree selection must be done with the site in mind. What you want out of your tree is a very important question before you plant it. A tree may be selected for its flowering, fruiting, leaves color, bark character or crown shape. A tree can also be selected for several functions like screening noise, pollution screening and control, wind modification, heat controller for its shade. According to your requirements research about your local trees. You do not want to plant an invasive species that will give more trouble than benefits. Contact your local nursery and talk with someone who knows about this. Decide if you want to plant a seed, a sapling or a slightly grown tree.

### 2. Planting:

1. Clean the tree planting site, remove any grass within a three-foot circular area and if it is a packed tree sample then unpack it and soak in water 3 to 5 hours. Do not plant with packing materials attached and do not allow roots to dry out.

2. Dig a hole in the cleaned area wider than it seems necessary. This is to ensure that the roots can spread without crowding or facing difficulty while growing. Turning soil in an area will aid root growth as well.

3. Plant the tree at the same depth it stood in the nursery packaging, without crowding the roots. Firm the soil around the lower roots and then slowly put in the remaining soil. It should be firmly, but not tightly packed with the shovel, hands and feet if necessary.

4. Give the tree plenty of water and it is also advised that a water-holding basin is constructed roughly around the tree.

5. After the water has sponged in, place a 2-inch deep protective mulch area 3 feet in diameter around the base of the tree (but not touching the trunk).

6. Water the tree generously every week or 10 days.





## Activity: Growing a bird habitat

### Concept

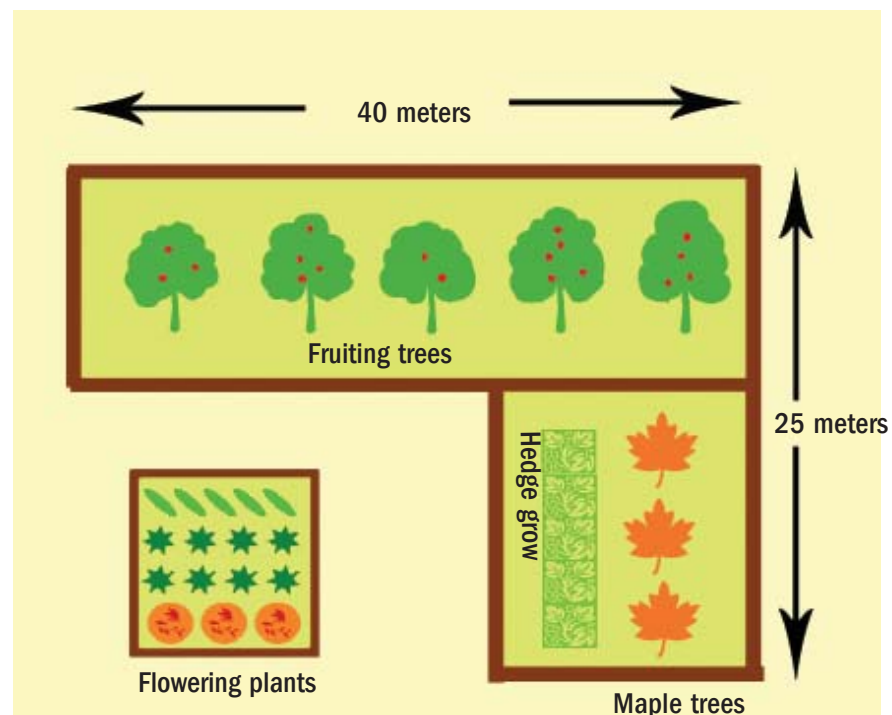
A bird habitat, or a butterfly garden or a vegetable garden is a perfect outdoor teaching laboratory for children, where the learning possibilities are abound. While growing a garden, students have real-life experiences with nature and can learn about:

- Ecosystems, habitats and biodiversity
- Life cycles and food chains
- Water, water quality and water conservation
- Zoology, botany and biology
- Recycling, composting and litter control
- Pollution
- Conservation and preservation

Designing a school yard garden or a vegetated area can provide students a lens for examining nature and its processes. By preserving the environment and creating safe havens for wildlife, students can learn to improve the balance of nature as well as the health of our planet.

### Purpose

To maintain green environment in home and school. This activity also enables students to be self reliant, bringing them closer to nature and also feel responsible for their own environment.



## Resources & Materials

1. Vacant land
2. Garden tools  
(spade, shovel, watering bucket, etc.)
3. Seeds of required trees, their saplings,
4. Water

## Activities & Procedures

1. Select a location. The location should preferably be in an area that receives ample sunlight.
2. Plan the type of garden you want to grow. Is it a bird habitat with trees, a vegetable garden or is it a flower garden for the butterflies. If it is a bird habitat, then you might want fruit trees or trees that might support bird nests. Select your plants accordingly based on weather, soil condition etc. Pay a visit to a local nursery or a seed vendor.
3. Ask and find out if the plants that you desire for your garden is planted in seed forms, as saplings or as cuttings. Then prepare accordingly.
4. Prepare seed bed a day or two before the actual planting. Remove rock and grasses from the area and make rows or beds according to your garden design with soft soil.
5. Explore your garden areas for insects. Get to the field and get your hands dirty if you have to and find out if your areas have beneficial insects or harmful ones. Page 28 has the list of most common bugs.

On the day of planting:

1. Make sure your beds is soft and ready for planting. Add some compost and get ready to plant.
2. Plant the seeds. Different seeds require different planting methods. For some, you will need to poke a hole in the soil, insert a single seed, and pat the hole shut. For others, you will sprinkle the seed across the surface of the

growing medium. Check the directions on the seed packet. For trees, refer to activity 8 and Annex 1.

3. Cover the seed if necessary. Some seeds need light to germinate, so you should leave them on the surface of the soil. Others require darkness and must be covered. They may germinate best with a deep cover or a very light cover.

4. If it is delicate seeds, then plant them instead in a tray with soil with a plastic cover. Check the seeds daily. When the first two or three seedlings pop out of the soil, remove the plastic cover. Keep the container in the same spot for another day or two, until most of the seeds have germinated. Don't let the soil dry out. When most of the seed germination is complete, move the seedlings to a sunny windows or plant them in your garden bed.

5. After the seeding, make sure that you weed and water. Try to put your garden to sleep for the winter. Plant a cover crop or cover with straw.

6. Your garden is ready, now pay attention, work hard and watch them grow!

7. This activity needs a long term commitment. Thus, it is best if the students form a nature club so that the responsibilities of maintaining it might be passed on. If not, then the hand over of the garden could be conducted at the end of every academic year or by a graduating class. A garden actually opens a door for many possibilities for learning and sharing knowledge on vast subjects.



## Activity: Sustainable Use of Trees and Making your own paper

### Concept

One of the biggest problems the environment is facing today is waste management. We use massive amount of materials and energy and waste them equally during our day to day life. All these materials and energies come from natural resources that are either renewable or non renewable. A non-renewable resource is a natural resource which cannot be produced, re-grown, regenerated, or reused on a scale which can sustain its consumption rate. These resources often exist in a fixed amount, or are consumed faster than nature can recreate them for example, fossil fuel like coal, petroleum and natural gas. Resources such as timber, when harvested sustainably or metals that can be recycled like aluminium are considered renewable resources.

Wood is one of the most widely used products, a renewable resource in our homes , schools and offices. It is estimated that 1.6 billion cubic metres (m<sup>3</sup>) of timber is harvested worldwide a year, which is a lot. Paper, a product of wood is also used and wasted in huge amounts among other materials like plastics and these in turn become a big headache for everyone, especially the municipalities which manages solid waste. Unless the trees are planted and wood is produced sustainably, the earth will not be able to replenish this demand. Apart from sustainable tree farming, one of the most effective solution to this problem is reducing your material usage every day, reusing them as much as possible and recycling their waste. This is also popularly known as the 'three Rs' - Reduce, Reuse and Recycle. The three Rs encourage us to rethink how and in what amounts do we consume materials and what we do with our waste. Reducing also involves taking your used goods to someone else, like old clothes, toys, utensils and furniture, while recycling is the reprocessing of used materials into new products. Its objective is to conserve and reuse valuable materials such as paper, metals, textiles, plastics and glass while reducing the production of new materials.

The use of recycled paper helps to decrease timber demand and in some cases protect wildlife habitats as well. Recycling can be carried out in different ways for different items. In many developed nations, organizations, schools and households can often get a tax deduction for recycling ones waste. It is upto us to make this concept popular in our communities by contacting different recycling centers in our cities. To begin with however, we can make our own recycled greeting cards this festival season and help protect trees. Our actions are more effective when done in groups and in mass. Let us start now!

### Purpose

To discover how important tree products are to us and to promote sustainable tree production. It is also to learn how to recycle and discover how easy it is to make recycled paper.





## Resources & Materials

### DISCOVERING WOOD PRODUCTS IN OUR LIVES

1. Notebook, chartpapers
2. Color pens

### FOR RECYCLING ACTIVITY

1. Scrap paper &/or newspaper
2. A blender ( optional)
3. Water
4. A bucket
5. A big square pan that's at least 8 cm deep
6. A piece of window screen that fits the Pan
7. An iron or rolling pin
8. A measuring cup
9. Muslin Cloth
10. Vegetable scraps or dye for colour, or dried flower petals (optional)

3. In a chartpaper describe the various processes by which trees are made into various wood products and how it can be sustainably used.

### FOR RECYCLING ACTIVITY

1. Tear the scrap paper into tiny pieces and soak them in a bucket of hot water for about 30 minutes. Beat the mixture until it is a creamy pulp with dye for color. Add a small amount of leaves or petals for added texture.
2. Pour the blended pulp into a measuring cup. Pour roughly 3 cm of water into the pan. Put the screen into the pan and pour one cup of the paper pulp onto the screen.
3. Spread the pulp evenly in the water with your fingers. It should feel kind of mushy. Lift the screen and let the water drain.
4. Lay the pulp covered screen face down on a muslin cloth (or a tea towel) or in between some newspaper. Lift the screen away, leaving the paper pulp on the cloth. Cover with another cloth and iron with a hot iron, or use a rolling pin to flatten and press out excess moisture. Let the pulp dry for at least 24 hours.

## Activities & Procedure

### DISCOVERING WOOD PRODUCTS IN OUR LIVES

1. To see how much trees we use in our homes and schools, look around and jot down all products made of wood in our class rooms and at their homes.
2. Bring them back to class and discuss the different products and figure out how important they are, what could be the alternatives and what are the sustainable practices that can be used to ensure the presence of forests.



Producing recycled paper uses 28-70% less energy and water than making new paper. It also produces fewer polluting emissions to air and water. Recycled paper is not usually re-bleached that reduces the amount of *dioxins*, which are released into the environment as a by-product of chlorine bleaching processes.



# Important Terms for Farmers

**Composting:** Composting is the purposeful biodegradation of organic matter such as yard and food waste. The decomposition is performed by micro-organisms, mostly bacteria, but also yeasts and fungi. These days “Vermicomposting” performed by earthworms is practiced widely as a viable and effecting composting method. Composting utilizes organic kitchen and yard waste and manures into an essential product which is useful to plants. The humus-like, soil end product, increases plant nutrition to the soil.

**Conventional Fertilizers:** These are chemical compounds that provide plants with some nutrients that they need to grow. This might be helpful in short term however might cause problems like water and soil pollution, biological magnification etc, if used in excess. Fertilizers typically provide, in varying proportions, the three major plant nutrients: nitrogen, phosphorus, potassium also known as N-P-K. Informed and controlled use is recommended.

**Crop rotation:** It is one of the oldest and most effective strategies for agriculture. It is a practice of growing a series of dissimilar types of crops in the same area in sequential seasons for various benefits such as to avoid the build up of pathogens and pests that often occurs when one species is continuously cropped. Crop rotation also seeks to balance the fertility demands of various crops to avoid excessive depletion of soil nutrients. Cover Cropping by mixing vegetables with other crops like grasses and legumes, that adds nitrogen to the soil can also be done to manage soil fertility, soil quality, water, weeds (unwanted plants that limit crop production potential), pests (unwanted animals, usually insects, that limit crop production potential), diseases, and diversity and wildlife, in agroecosystems.

**Integrated Pest Management (IPM):** It is an effective and environmentally sensitive approach to pest management that relies on a combination of common-sense practices, using information on the life cycles of pests and their interaction with the environment. This information, in combination with available pest control methods, is used to manage pest damage by the most economical means, and with the least possible hazard to people, property, and the environment. The IPM approach can be applied to both agricultural and nonagricultural settings, such as the home, garden, and workplace.

**Organic Fertilizer:** Naturally grown organic fertilizers include manure, slurry, worm castings, peat, seaweed, sewage, and guano. Green manure crops are also grown to add nutrients to the soil. Naturally occurring minerals such as mine rock phosphate, sulfate of potash and limestone are also considered organic fertilizers. Manufactured organic fertilizers include compost, rock phosphate, bone meal, blood meal and seaweed extracts.

**Pesticides:** It is a substance or mixture of substances used for preventing, destroying, repelling or mitigating any pest. A pesticide may be a chemical substance, biological agent (such as a virus or bacteria), antimicrobial, disinfectant or device used against any pest.

**Scarification:** Scarification is the process of reducing or breaking the seed coat so that moisture can penetrate and the embryo can begin the germination process. Scarification is commonly required on seeds with dense or hard seed shells. Many tree seeds do not require any scarification, and for those that do, the most common treatment is a simple water soak. Hard seed coats can be broken down by a) a water soak, b) a physical or mechanical breaking of the seed coat, or c) a chemical or acid treatment (not commonly required).



# Creatures in our gardens

**BENEFICIAL BUGS AND OTHER CREATURES:** There are several bugs and insects that therefore are beneficial in our vegetable gardens. They kill the pests and make the vegetables thrive. It is important to know who are our friends.

## Earthworms



Earthworms play a major role in converting large pieces of organic matter (e.g. dead leaves) into rich humus, improving soil fertility. It also ingests other soil particles including stones up to 1.27 mm across. It then excretes making minerals and plant nutrients accessible. Reports show that fresh earthworm casts are 5 times richer in available nitrogen, 7 times richer in available phosphates and 11 times richer in available potash than the surrounding soil. By its burrowing actions, the soil structure is maintained with channels for aeration and drainage.

## Lady beetles or Lady Bugs



They are among the most visible and best known beneficial predatory insects. They feed primarily on aphids and also on mites, small insects, and insect eggs. Their black spots on red or yellow bodies are famous all over the world. Some lady beetles are black, often with red markings. Many crops benefit from lady beetles. They are helpful for growers of vegetables, grain crops, legumes, strawberries, and tree crops.

## Spined Soldier Bugs



Adults vary in color from yellowish to pale brownish and are covered with small black specks. There is also a short black line on the wing tips which extends beyond the abdomen. A conspicuous spine on the middle of the front tibia may also be noticed. They are about 1.27cms long. Their preys include many kinds of caterpillars and grubs, especially those with few hairs. They are known to prey on larvae of the fall armyworm and the potato beetles.

## Lacewings



Lacewings are delicate looking, soft bodied insects with a wingspan ranging in size from 5 to 150 millimeters and a body up to 50 millimeters in length. Some green lacewings will eat only about prey items in their entire life, in other cases they can eat upto 100 aphids in a week. In several countries, millions of such voracious *Chrysopidae* are reared for sale as biological control agents of insect and mite pests in agriculture and gardens.

**HARMFUL BUGS:** Bugs that are bad for our plants and flowers exist in large numbers and we need to know which are bad ones so that we can make our garden free of pests as far as possible. Using excessive pesticides should not be the only means of getting rid of these pests. They can be plucked off manually too. It is however advised that Integrated Pesticide Management should be practiced even if one has to use pesticides.

#### **Tomato hornworm**



The tomato hornworm is a large pale-green caterpillar with white and black markings. The caterpillar measures about 10 cms in length when fully mature. A spike on one of the “tail” gives the caterpillar the name hornworm. The hornworm feeds on the leaves and new stems of the tomato plant, causing extensive damage. During July and August they also occasionally feed on the fruit.

#### **Cucumber beetle**



Adult spotted cucumber beetle feed on the leaves of many vegetables as well as on soft fruit including shoots and blossoms. They may also spread cucumber mosaic virus or wilts in cucurbits. Larvae feed exclusively on roots, but do not generally damage garden plants. However roses are reported to be affected.

#### **Aphids**



Aphids are tiny insects that feed on the buds of roses and other flowers. They are extremely small creatures, usually growing around 3 mm in length. Some adults have wings whereas others don't and it is possible to have more than 20 different species of aphid attacking a garden.

#### **Leaf cutter Ants**



Leafcutter ants can wreak havoc on your garden, trees, shrubs; etc. These ants will basically strip an entire plant of all of its leaves, which can seriously damage it with time. Your plants will regrow their leaves, but the leafcutter ants may return and strip them all over again.

#### **Tussock Caterpillars**



Caterpillars, maggots, larvae of many moths and butterflies are actually pests for plant. However, if moths and butterflies are what you want in your garden then they are not pests. But if it is a vegetable garden then you have to keep an eye on the larvae and caterpillars. The Tussock Caterpillars and larvae, at first skeletonize leaves, and then devour all but the main vein and petiole.



# Some Fun Facts about Trees

- Dendrochronology is the science of calculating a tree's age by its rings.
- Tree rings provide precise information about environmental events, including volcanic eruptions.
- A mature birch tree can produce up to 1 million seeds per year.
- Moon trees were grown from seeds taken to the moon by Stuart Roosa, Command Module pilot of the Apollo 14 mission of January 31, 1971.
- One tree can absorb as much carbon in a year as a car produces while driving 26,000 miles. Over the course its life, a single tree can absorb one ton of carbon dioxide
- A single tree produces approximately 260 pounds of oxygen per year. That means two mature trees can supply enough oxygen annually to support a family of four.
- The 236 ft or 72 m high Ada Tree of Australia has a 50 ft or 15.4 m girth and a root system that takes up more than an acre.
- The world's tallest tree is a coast redwood in California, measuring more than 360 ft or 110 m.



A redwood

# Glossary

**Biodiversity:** It is variety of different species of both plants and animals including microorganisms. It can be also described as the variation of life forms within a given ecosystem, biome, or the entire Earth. Biodiversity is also used to measure health of a particular biological system. Today the earth consists of millions of biological species, which is the product of 3.5 billion years of evolution.

**Capillary Motion:** This refers to a movement of liquids in thin singular tube like passage ways or flow of liquids through porous media, such as the flow of water through soil.

**Dioxins:** They are environmental pollutants. They cause damage to a number of organs and systems. Once they enter the body, they endure a long time because of their chemical stability. They are formed during combustion processes such as forest fires, volcanic eruptions, backyard trash burning, as well as during some industrial processes such as paper pulp bleaching and manufacturing of some herbicides and pesticides. Solid waste and hospital waste incinerations are often the worst, due to incomplete burning.

**Ecosystem:** An ecosystem is a natural unit consisting of all plants, animals and micro-organisms (biotic factors) in an area functioning together with all of the physical (abiotic) factors of the environment. Ecosystems can be permanent or temporary, big or small. Thus in an ecosystem organisms are interdependent on each other and has a number of food cycles.

**Food chain:** It describes the eating relationships between different species within an ecosystem or a particular living place. Every known food chain begins with a type of autotroph or a food maker like a plant or some kind of unicellular organism.

**Fossil Fuel:** Fossil fuels or mineral fuels are fuels formed by natural resources such as anaerobic decomposition of buried dead organisms on land or at bottom of seas and lakes. Formation of fossil fuels sometimes exceeds 600 million years. They contain high percentage of carbon and hydrocarbons and are of great importance because they are used to produce energy that we need. Coal, natural gas and petroleum

are the best examples of fossil fuel however they are also the major factors of different kinds of pollution.

**Germination:** It is a process in which a seed or spore emerges from a period of dormancy into a very young plant. The most common example of germination is the sprouting of a seedling from a seed of an angiosperm or gymnosperm.

**Habitat:** It is an environment that is a natural home for a particular animal or plant species. Different species have different requirements to survive and thus their natural habitat also varies.

**Herbarium:** A herbarium is a term used in study of plants. It is a preserved plant specimen. This specimen may be a whole dried plant or parts of a plant. The dried form of a plant is mounted on a sheet and labeled properly. However, depending upon the type of plant, it may also be kept in alcohol or other preservative.

**Life cycle:** A life cycle is a period involving all different stages from birth to reproduction to death which enables a generations of a species carry on to survive.

**Solid waste:** This refers to different household or domestic waste like kitchen waste, garbage, plastic, paper, etc. They often include the addition of commercial wastes and are in are usually in solid or semisolid form and generally exclude industrial hazardous wastes.

**Transpiration:** It is the evaporation of water from the aerial parts of plants like leaves, stems, flowers and roots. Leaf surfaces have openings called stomata through which transpiration occurs and also allows the diffusion of carbon dioxide gas from the air for photosynthesis. Transpiration also cools plants and enables mass flow of mineral nutrients and water from roots to shoots.

**Vegetation:** It is a general term for plant life or a plant community in a particular region also refers to the ground cover provided by plants. It is a general term without referring to a specific type, structure or geographic characteristics.

# Fun Learning Activities with Trees

## Find your tree

### Materials:

1. Half the number of scarves as the number of persons participating
2. Area with trees

Divide the group in pairs. Ask one partner, the leader for the time being, to blindfold the other with the scarf. The leader guides the blindfolded partner to a tree with not necessarily the shortest route and back the starting point. It must be possible to see the tree from the starting point.



Art: Eva Wulff

Now, the blindfolded partner must explore the tree without removing the scarf, using all his senses, for e.g. by smelling and touching. Then the leader takes the blindfolded friend back to starting point and the scarf is removed. The trick is now the blind folded person must find the tree he/she was taken to. The persons who can find their particular tree within a certain fixed time can be termed as winners, and the process can again be repeated with the other partner.

The purpose of this activity is to make students warm up to trees using their basic senses. Using hands and smelling the trees can be helpful in evoking positive feeling about trees.

## Counting Tree Rings

### Materials:

1. Cross-section of wood showing tree rings you can visit a carpenter or local lumber factory, most likely they will be able to provide you with trees cross sections)
2. Sandpaper



Find a tree that has been cut down. Sandpaper can be used to smoothen the surface of the stump so that the rings are visible.

Starting at the center of the stump, the rings can be counted. Please not that a set of light and dark lines counts as one ring. Each ring stands for one year in the tree's life. It might be observed that that some of the rings are wider than others. Wide rings show years when the tree grew a lot. Narrow rings show years when the tree grew less. So how old was the tree? Ask the students to think of all the reasons why the tree might have grown more in some years than in others? The students can perhaps again write a story on the tree!

The purpose of this activity is to familiarize the students about the tree rings. Counting the tree rings is an easy way to figure out a tree's age. This method could be an ideal way to show how trees respond to years of good and bad weather.

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Wildlife Conservation Nepal



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